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BUILDING GENERALIZED RESPONSE SYSTEMS.

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BAER, PETERSON, AND SHERMAN HAVE ATTEMPTED TO BUILD A GENERALIZED RESPONSE SYSTEM (GRS) IN THE FORM OF IMITATIVE BEHAVIORS (IB) IN THREE SEVERELY RETARDED CHILDREN (S'S). IN THE FIRST PHASE OF THE STUDY, 130 IMITATIVE RESPONSES WERE TAUGHT BY IMMEDIATE, INDIVIDUAL REINFORCEMENT. THE S'S ALSO PERFORMED RESPONSES WHICH WERE NEVER REINFORCED. BY MANIPULATING THE PRESENTATION OF THE IMITATIVE STIMULUS, IT WAS POSSIBLE TO FURTHER CONTROL A GROUP OF BEHAVIORS AND ISOLATE A SUBSET OF THE IMITATIVE CLASS. IN ASSESSING THE STRENGTH OF THE INTERRELATIONSHIPS BETWEEN IB, IT WAS FOUND THAT AN IMITATIVE STIMULUS COULD BE EXTINGUISHED INDIVIDUALLY, BUT WHEN PRESENTED WITH OTHER REINFORCED IMITATIVE STIMULI, THE CHILD PERFORMED THE RESPONSE. THE SIMILARITY OF RESPONSE BETWEEN CHILD AND MODEL IN MAINTAINING NONREINFORCED IB WAS ALSO STUDIED. RESULTS WERE NEGATIVE. FINDINGS INDICATE THAT BOTH IB AND NONIMITATIVE BEHAVIORS ARE PART OF A GRS. BUILDING A GRS MUST INVOLVE COMMON ELICITING, DISCRIMINATING, OR REINFORCING STIMULI. ISOLATION OF THE STIMULI DIMENSIONS WHICH CAUSE INTERLOCKING BEHAVIORS MAY BE AN IMPORTANT AREA FOR FUTURE RESEARCH. THIS PAPER WAS PRESENTED AT THE AMERICAN PSYCHOLOGICAL ASSOCIATION CONVENTION (75TH, WASHINGTON, D.C., SEPTEMBER 1967). (PR)

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Building Generalized Response Systems[1]

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When one considers the extremely large behavioral repertoire of the mature individual, it is interesting to note just how flexible behavior can be. An apparently small or subtle cue may have considerable influence over a wide range of behaviors, causing some to be strengthened and others to be weakened. Even casual observation suggests that every response need not be contingently related to a stimulus for it to be changed in strength. For example, the type of response made by a pretty girl to a single overture on the part of a young man may have far reaching effects.

What is interesting from a psychological viewpoint are the processes involved in making these effects so far reaching. What is indeed curious is the fact that although only a few responses may enter into a contingent relationship with a stimulus, a large number of responses which do not have such a relationship are often similarly affected.

This type of interaction among behaviors is evidence of what has been termed a "functional response class" or a "generalized response system". A generalized response system may be characterized as a group or set of responses which share certain common properties. To elaborate, a generalized response system consists of behaviors which have the same functional relationship to common controlling stimuli. The controlling stimuli may have an eliciting, discriminative, or reinforcing function and may influence a set of behaviors in such a way that they become inter-related in that variables which operate directly on some responses indirectly affect

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other responses. When such interrelationships can be demonstrated, a generalized response system is said to be in existence.

The fact that certain behaviors share common properties, however, does not indicate that the behaviors are members of a generalized response system. Behaviors which are topographically similar such as aggressive responses or exploratory behaviors are often believed to be members of the same functional response class. Topographic similarity however, is no guarantee that the behaviors are members of a generalized response system. A generalized response system is present only when there exists an interrelationship among responses such that stimulus changes which act to strengthen or weaken a particular behavior also affect other behaviors which did not enter into a contingent relationship with the stimulus event.

As an example, let us consider the child who maintain's his mother's attention by displaying a number of undesirable behaviors. He calls his mother's name, cries, spits, and throws objects. Subsequently, mother punishes him for spitting and throwing. As a result crying and calling her name may also be reduced in strength. These behaviors could be viewed as members of a generalized response system. In such a case the child shows a great deal of flexibility in adapting to his environment. This flexibility results because it is not necessary to weaken or strengthen all the responses in that particular response system.

Another example of a generalized response system may be found in a recent study by Baer, Peterson and Sherman (1967) who attempted to build a repertoire of generalized imitative behaviors in three severely retarded children. These children were observed at length

and judged to possess little, if any imitative behavior. Subsequently, the experimenter began to teach imitative responses. He looked at the child and said, "Do this" and performed a response such as raising his arm. Since the child did not imitate his behavior, he took the child's arm, raised it, said "Good", and gave the child a bit of food. This procedure was repeated a number of times. After a while the experimenter began to reduce his assistance in helping the child perform the response until the only stimulus for the child's response was the initial raising of the E's arm. In this manner the subjects were taught a variety of simple behaviors such as tapping a table, opening a drawer, and putting on a hat.

After the subjects had learned a number of such responses they showed an increasing tendency to imitate new behaviors on which they received no training. By the time two of the subjects had learned some 130 responses they were able to imitate almost any simple motor behavior the first time it was presented. The data on one of the subjects are shown in Figure 1.

In addition, the subjects continued to perform a number of responses which were never reinforced. It seemed likely that these responses were members of the more general class of imitative behaviors and were indirectly under reinforcement control. In order to test this assumption a 30-second delay of reinforcement (DRO 30") was introduced. As a result, both reinforced and non-reinforced imitative responses declined in strength. When reinforcement was again immediately contingent upon an imitative response, both types of responses returned to their former levels of performance. This result may be seen in Figure 2. Thus it seems probable that nonreinforced imitative behaviors were under

the control of reinforcement. Interestingly though, they had never been directly reinforced.

Thus far we have seen how a set of imitative responses, some of which had never been reinforced, operate as a functional class of behavior. It is also possible however, that contingencies may operate within a class of behaviors and create another type of response organization. For example, the data viewed on the previous subject show a decline in response strength with the introduction of noncontingent reinforcement. However, with this subject not all responses declined as a result of this procedure. In fact, some responses proved remarkably resistant to extinction. An analysis of the interaction between child and experimenter revealed that in the case of the extinction-resistant behaviors, an additional contingency was in operation which overcame the effects of the 30-second delay of reinforcement.

The contingency responsible involved the manner of presentation of the imitative stimulus. For those responses which did immediately extinguish, the imitative stimulus was presented briefly and terminated before the child had a chance to respond. In the case of those responses which did not readily extinguish, the presentation of the imitative stimulus was continued until the child responded; e. g., if the S was to stand up, the E continued standing until the S responded; if the S was to place her hand on her head, the E's hand remained on his head until S responded. It should be noted that the 30-second delay did not begin until either the E terminated the imitative stimulus or the S performed the response. Thus, in some cases the E was in effect forcing the S to respond, because only a response would begin the 30-second delay, which ultimately ended

with reinforcement. By manipulating the presentation of the imitative stimulus during noncontingent reinforcement, it was possible to control a group of behaviors. A demonstration of this control was undertaken with six responses and is shown in Figure 3. Of these six responses, two had never been reinforced. Thus they did not directly enter into the reinforcement delay. Nevertheless, these responses were under the control of the stimulus termination contingency. When the termination of the imitative stimulus was contingent upon the child's response they were performed; when it was not, they were not. These results suggest that one might view these behaviors as a sub-set of the imitative class. The sub-set of behaviors was under the control of reinforcement in certain conditions and under additional control by the form of stimulus presentation in other conditions.

One of the basic questions concerning functional interrelationships of responses centers around the limits of these relationships. It would be valuable to know how a response might be removed from a class of behavior and conversely, how a behavior might be added. In other words, it is important to know the organizational strength of a particular response class. Such knowledge might be useful to both the educator who is interested in building new response systems and to the clinician who may want to break up certain kinds of behavioral organization. The following operations were undertaken in order to assess the strength of the interrelationships between imitative behaviors.

First, the stimulus for one imitative response was repeatedly presented. The response was not reinforced. Thus the E would say "Do this" and put his hand on his head. The S would imitate his

response. This sequence was repeated until the S failed to perform the response 30 times in a single session. In all, six responses underwent extinction. Next the stimulus for one of these responses was presented along with stimuli for eleven other imitative behaviors which had not undergone extinction. If the child performed any of the eleven imitative responses she was reinforced. If the previously extinguished behavior was displayed following its stimulus, the E paused 20 seconds, and then presented another stimulus.

The result of this procedure may be seen in Figure 4 which shows that when an imitative stimulus was repeatedly presented without reinforcement, the child failed to respond. However, when this same stimulus was presented along with other imitative stimuli which were reinforced, the child performed the response. Although only one response is seen here, this finding was true for all six responses which underwent extinction.

One explanation for this effect presumably lies with the fact that reinforcement was dispensed for most responses in the imitative class. In an earlier experiment (Figure 2) when reinforcement was delayed and made noncontingent the rates of both reinforced and non-reinforced responses declined. When reinforcement was later immediately contingent, both reinforced and nonreinforced responses were displayed.

In addition to reinforcement, a second factor may also be important in the development and maintenance of a functional imitative class. This factor involves a stimulus dimension which might be labeled "similarity of response between child and model". Despite the fact that the imitative responses learned by the child differ considerably in topography, they all have the general property of

being similar to the behavior of the experimenter. This dimension of similarity then is not a physical property of a single behavior and is not independent of the behavior. Similarity, therefore, may be classified as an abstraction. An abstraction is a single stimulus property which controls behavior. It may be developed by systematically reinforcing responses made in the presence of a particular stimulus dimension while extinguishing all other types of stimulus control.

Recently the author attempted to test whether the abstraction "similarity of response between child and model" was crucial in maintaining nonreinforced imitative behaviors. This was carried out by teaching the child a series of nonimitative behaviors. Thus a response on the part of the E such as stamping his foot, was the discriminative stimulus for a quite different response on the part of the child, e. g. opening a box. After the child learned five such behaviors the responses were extinguished and subsequently the stimulus for each was interspersed among stimuli for reinforced imitative behaviors. If the dimension of behavioral similarity was crucial then these nonimitative behaviors should not be performed when not reinforced. The result was that four of the five nonimitative responses extinguished when interspersed among stimuli for reinforced imitations. However, when the E attempted to again intersperse stimuli for nonreinforced imitative behaviors, they too extinguished. This result was, of course, in sharp contrast to earlier findings.

A second test of the function of similarity was then undertaken. Stimuli for nonreinforced imitations were interspersed among stimuli for reinforced imitations. If the child failed to

perform the nonreinforced response she was prompted to do so. Subsequently, nonimitative responses were also interspersed among the imitative behaviors and received prompts if necessary. The behaviors were not reinforced. After ten sessions three nonimitative behaviors were subjected to successive periods of repeated and interspersed presentation, again without reinforcement. Without exception the nonimitative responses extinguished under repeated evocations and were performed when interspersed among reinforced imitations. This result indicates that at least at this point in the study, similarity of response between child and model was not crucial to the performance of nonreinforced imitations. (This is not to say, however, that such similarity may not be critical for the initial development of stimulus control over imitative behaviors.) Thus it seemed likely that an even larger response class had developed. Such a class included both imitative and nonimitative behaviors. A demonstration of such a class was therefore attempted. Stimuli for four nonimitative responses were interspersed among ten reinforced imitations. These nonimitative responses were never reinforced. After a stable baseline of behavior had been established reinforcement for imitative responses was discontinued. If the child did not respond within 30 seconds, the stimulus for the next response was presented. After a short period, imitative behaviors were again reinforced. The results may be seen in Figure 5.

This figure shows that as soon as reinforcement for imitative responses was discontinued, both imitative and nonimitative behaviors extinguished. When reinforcement was resumed, both types of responses were again performed. This finding suggests that both imitative and nonimitative behaviors were now part of a generalized response system.

Building a generalized response system is, of course, a complex task. It seems likely that regardless of the specific techniques employed in establishing such a system the procedures must involve common eliciting, discriminative, or reinforcing stimuli. It is possible that in developing some generalized response systems reinforcing stimuli may play a more important role than discriminative stimuli; while in other systems the opposite may be the case. Cooperative behavior might be a generalized response system which is primarily based on the reinforcing properties of certain kinds of personal interaction. Thus, conditions which weaken the reciprocal reinforcing relationship between two individuals on some occasions may also indirectly weaken cooperative responses on other occasions or in other settings.

A second example may be seen in the previously described child who exhibited a number of undesirable behaviors which were a function of attention given by his mother. In order to modify this generalized response system one would likely alter the reinforcing stimuli which follow the behavior. A third example may be found with the child who apparently "understands" what to do when instructed by an adult but seldom does what he is told. Reinforcement given for following a limited number of instructions or commands may result in an increased tendency to follow new commands which have never been reinforced.

In contrast, the development of some generalized response systems may necessitate not only reinforcing stimuli but certain common discriminative stimuli. Imitation appears to fall in this category. In order to develop the imitative repertoire reported by Baer, et al. (1967), the child was differentially reinforced for a

variety of behaviors. Although the behaviors were topographically quite different, all had a common stimulus dimension--that of matching the behavior of the experimenter. As a result responding along this dimension was strengthened and the children soon matched the E's behavior without further training. It was noted earlier that the dimension to which the children were apparently responding was not a physical property but was abstracted from a variety of stimuli.

Common dimensional stimuli may be important in a large number of behaviors. In this regard imitation may be related to certain types of problem solving skills. Problems involving the abstraction of certain common elements for solution such as reasoning by analogy may be dependent on discriminative stimuli for maintenance as a generalized response system. This may also be true for problems involving classification or concept formation.

These common stimulus dimensions, however, may be quite complex. Such complexity is illustrated in a recent study by Herrnstein and Loveland (1966) who taught pigeons to respond differentially to a series of slides containing human and non-human forms. The human forms differed in number, color, dress, size, and amount of exposure yet the pigeons were able to abstract the dimension or concept of people and indicate when a slide contained a person and when it did not. It would appear that Herrnstein and Loveland may have built a generalized response system by differentially reinforcing responses made to a particular stimulus dimension.

It should be added that experimental differentiation of generalized response systems into those based primarily on discriminative versus those based primarily on reinforcing stimuli may prove extremely

difficult. Both aspects of control will no doubt interact in a variety of response systems. However, the isolation of those stimulus dimensions which do cause behaviors to interlock and be strengthened or weakened as a unit would undoubtedly prove to be valuable knowledge. Such knowledge would not only further theoretical formulations of behavior but in addition increase the psychologists' effectiveness in dealing with social, educational, and clinical problems.

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2. Peterson, R. F. The organization of experimentally generated imitative behaviors in the retardate. Unpublished doctoral dissertation, University of Washington, 1965.

Footnotes

1. Paper presented in a symposium on Achieving Generality of Behavior Change at the 75th annual meeting of the American Psychological Association, Washington, D. C., September 1967.
2. Support for this research was given by the United States Public Health Service, National Institute of Mental Health, (MH 02208 and MH 12067).

DEVELOPMENT OF GENERALIZED IMITATION

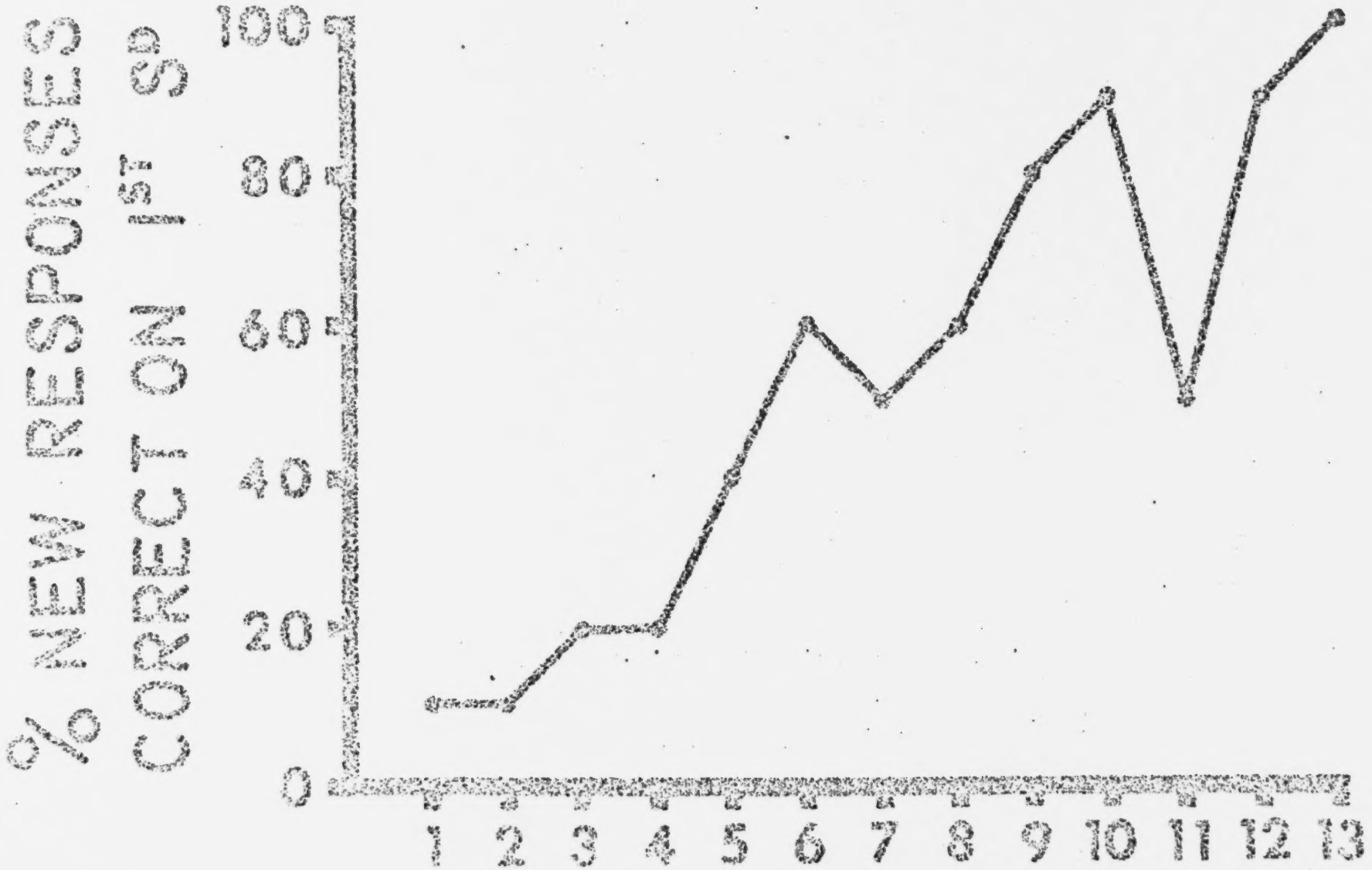
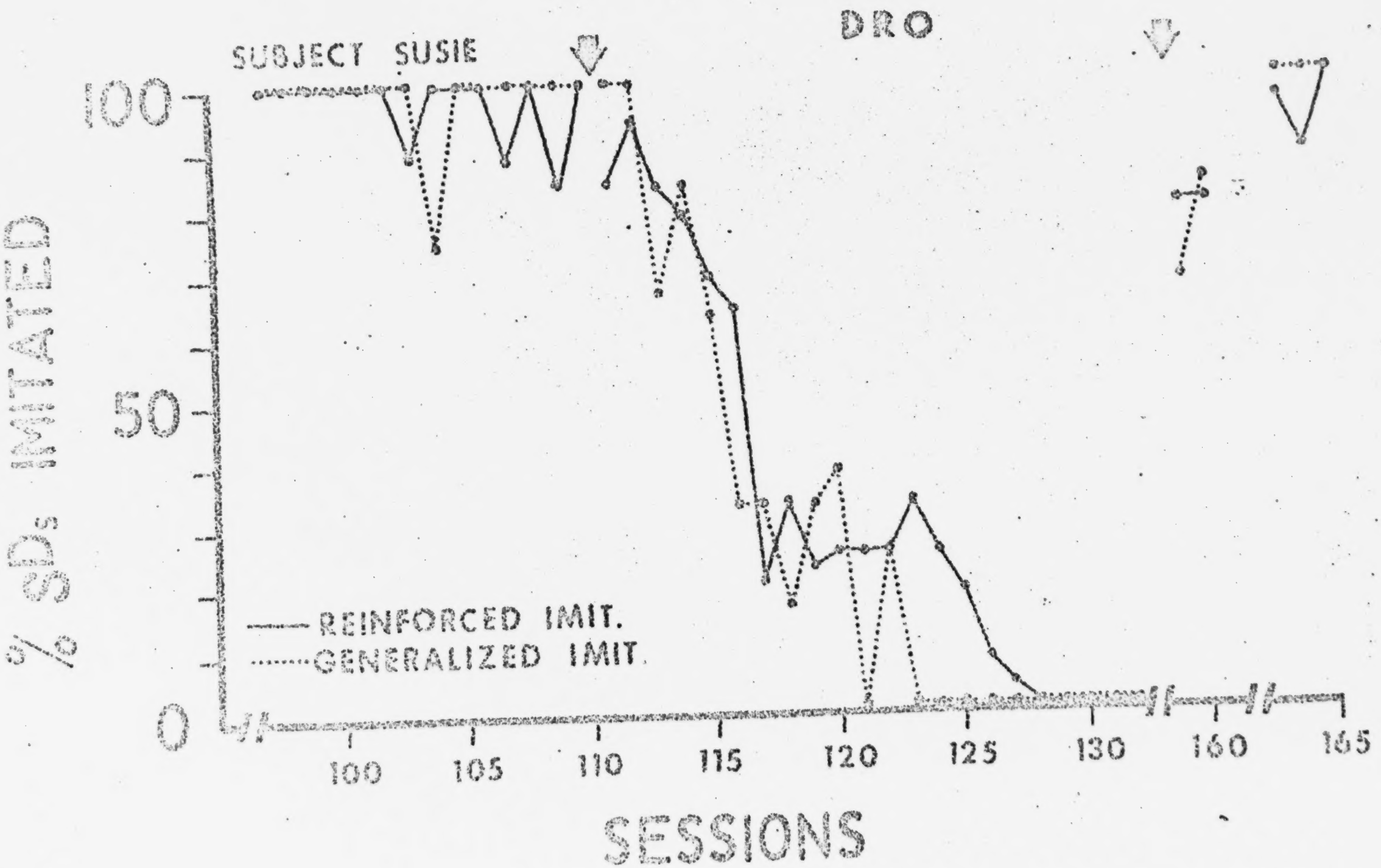


FIGURE 1.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0
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GENERALIZED IMIT.
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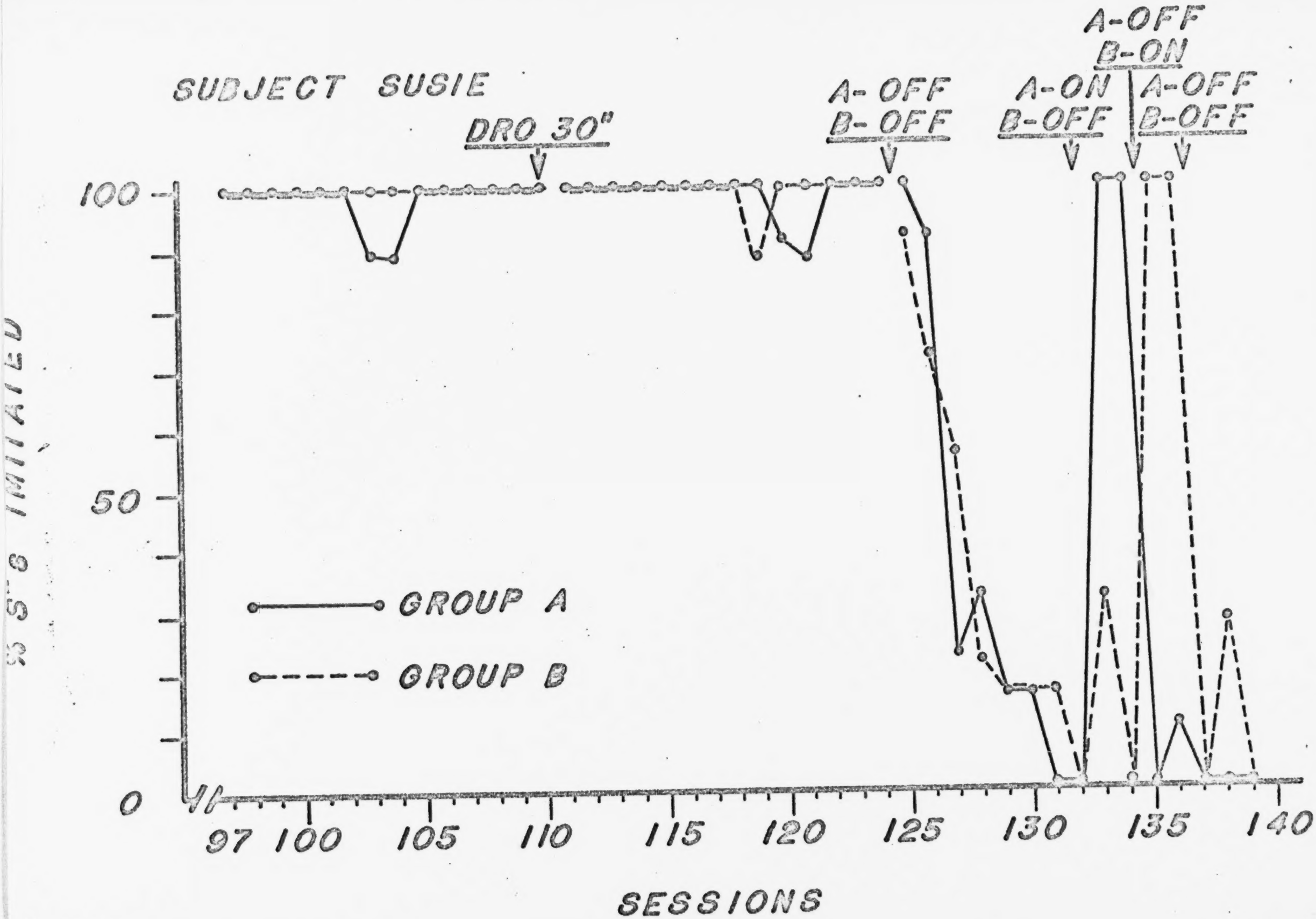
110
115
120
125
130
160
165
SESSIONS

FIGURE 2.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B- OFF
A-OFF
B-ON
A-ON
B-OFF
A-OFF
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RESPONSES IMITATED
GROUP A
GROUP B
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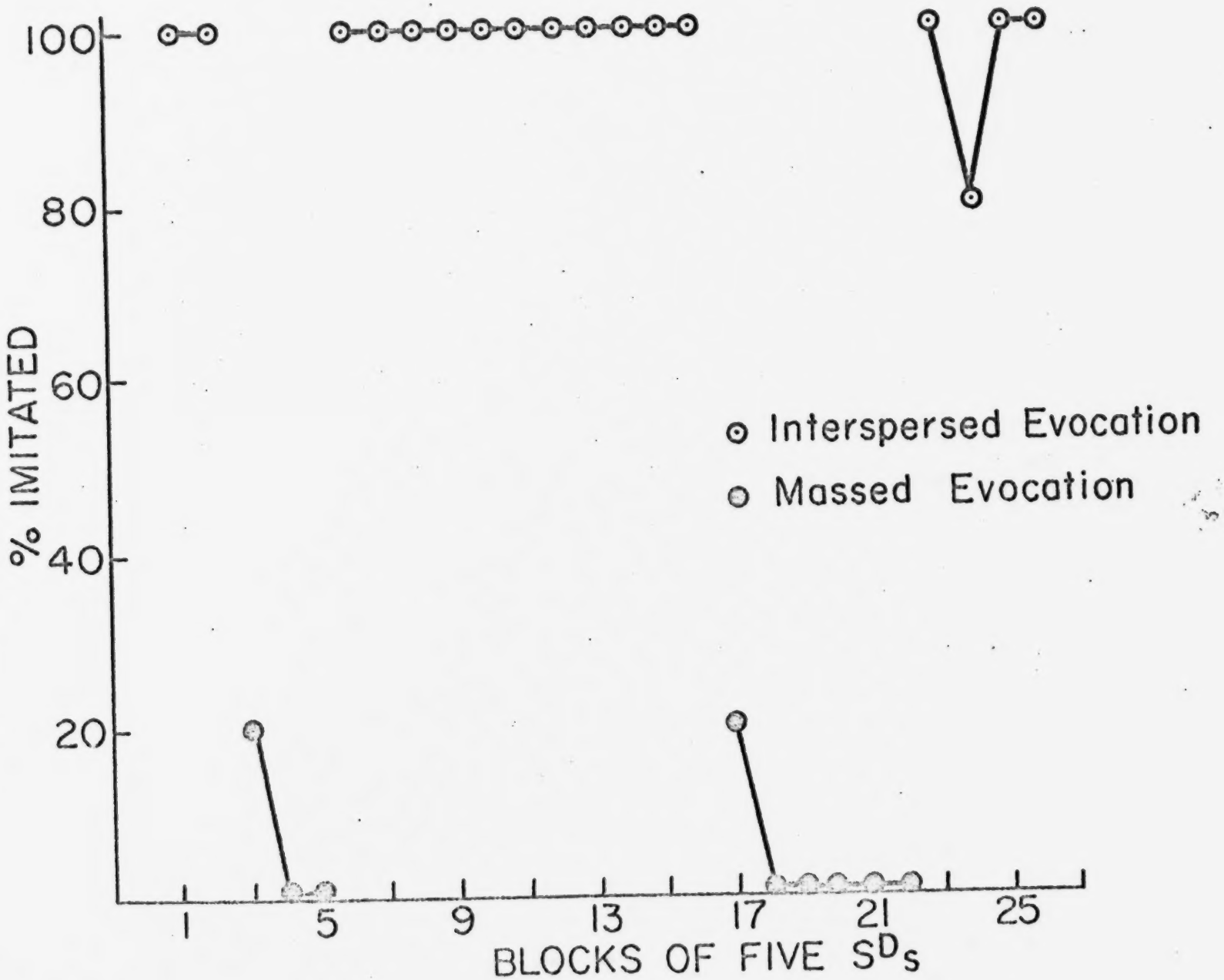
SESSIONS

FIGURE 3.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80
60
40
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% IMITATED
Interspersed Evocation
Massed Evocation
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5
9
13
17
21
25
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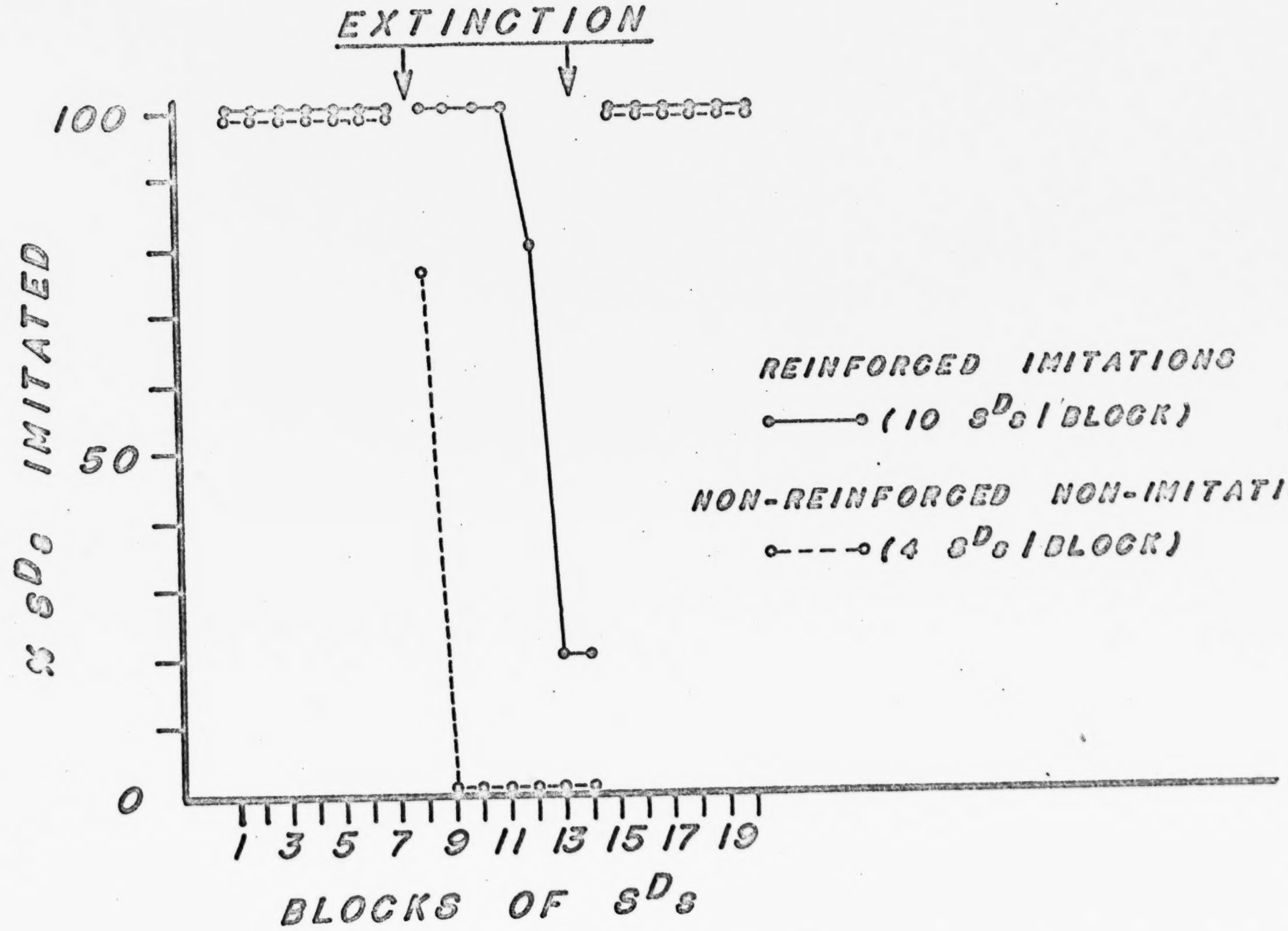
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0
IMITATED
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REINFORCED IMITATIONS
(10 S^Ds / BLOCK)
NON-REINFORCED NON-IMITATIONS
(4 S^Ds / BLOCK)
1 3 5 7 9 11 13 15 17 19
BLOCKS OF S^Ds

FIGURE 5.